tural Institute, and was eventually very much transformed and completed, as shown by his lectures, published in 1891.[6]

Renouncing the excessive simplification (which, however, was useful in its day) which caused M. de Tastes to look at the total thickness of the atmosphere as being mobile on the whole, M. Duclaux finds in a happy combination of the equatorial circulation of Hadley with the temperate circulation of M. de Tastes, the justification of the rôle of the Gulf Stream in the formation of the horizontal circuit of the temperate regions (Chap. XIX, p. 276). He then defines the manner in which the current encroaches upon the region of high pressure, or "isle of calms" (Chap. XX, p. 310), and, especially, he introduces the explanation (new as well as correct) of those conditions, which are shown on the isobaric charts as X-shaped isobars, and which some meteorologists study only by halves, under the name of V-shaped depressions. This form, which reminds one of the typographic trace of a neck between two mountains, corresponds to the overlapping of two layers of current in the "isle of calms" (page 312). "The presence in the atmosphere of layers of different temperature and animated by different velocities appears to be very common and has been observed in all aeronautic ascensions." It is to these currents halfway up in the atmosphere that are due the hailstorms of spring and the majority of thunderstorms (Chap. XX, pp. 312–322, and Chap. XXII, pp. 353–363). Nothing is clearer and more precise than his descriptions of the various atmospheric conditions, their characteristics and their results.

Finally, I will close by the following remark, which I have insisted upon in my lectures at the Agricultural Institute, as supplementary to those of 1891 to 1896 by M. Duclaux: At the surface of the earth every belt of low pressure is necessarily occupied, not by one current, but by two opposed and contiguous currents. As long as the wind is not very strong, each of these has high pressures on its right in the Northern Hemisphere. Either of these currents, or even both, may be continuous with the areas of high pressures on their borders, or on the other hand be entirely distinct from them. The chart of theoretical atmospheric currents to which this remark refers differs in some interesting particulars from that of M. de Tastes.

The necessity of studying the earth as it really is and not as an ideal uniform globe appears in numerous articles of various degrees of importance published by our naval officers and our French engineers. I will cite a single example:

The Revue Maritime et Coloniale published in 1894 an extensive memoir by M. Duponchel, who does not appear to have been acquainted either with the memoirs of M. de Tastes or with the work of M. Duclaux. M. Duponchel, whose first note on this subject was written in 1889, seems to have arrived independently at views quite similar to those of M. de Tastes, views which he has explained with his usual vigor in a pamphlet of 1892 and in various articles in the Revue des cours scientifiques.

But notwithstanding some ingenious considerations, these memoirs do not add anything to that of M. de Tastes; neither do they add anything to M. Duclaux' work. None of the criticisms of M. Duponchel's views made by naval Lieutenant Tournier[7] apply to the exposition of M. Duclaux.

Without entering into further details, two words will suffice to put the reader on his guard against mixed (theoretical and observational) memoirs.

The influence of the continents and oceans in our Northern Hemisphere—the only one which is well known—is so overwhelming that there is no reason to admit the slightest resemblance between the distribution of pressure and temperature deduced from observations by taking the means by parallels of latitude and the distributions that the same astronomical conditions would produce upon a truly uniform globe. As to the mean wind of the temperate regions—what can it be?

There is, therefore, no reason to attribute a closer relation between scientific facts and the results of those authors who, like Ferrel and Möller, make partial use of these average data, than between the results of those in which a purely theoretical point of view prevails. As regards these latter, we must not judge them from the more or less complete agreement of their results with the said means of observations, but solely according to the rigor of their mechanical and thermodynamic reasoning, and from this point of view no memoir can compare with that by von Helmholtz. He seems to me to have exhausted the subject that he treats of "The circulation of a dry, gaseous atmosphere upon a polished globe, revolving like the earth."

But this is not the last stage; we must find a rigorous treatment of the problem proposed by M. de Tastes, that of the atmospheric circulation upon the earth as it really is—at least in its general features. In attacking this directly, M. de Tastes has been forced to be content with rather vague considerations. To-day the instrument of attack has been forged by von Helmholtz; the principles of the mechanics of the atmosphere, the part played by the mixtures and that played by the resistance of the ground have all been clearly analyzed. It therefore seems that we need only to make known these principles in order to quickly stimulate purely theoretical studies, the comparison of which with observed types—not with averages—may be reasonable. This is the only method of discovering whether all the important elements have really been taken into consideration. It is for these reasons that the publication of the principal theoretical memoirs on the general circulation of the atmosphere at the surface of a uniform globe has seemed to me to be opportune.

[6] Cours de physique et de Météorologie professé à l'Institut agronomique. Hermann, 8 rue de la Sorbonne, Paris.

[7] Revue marit. et colon., October, 1894.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. Maxwell Hall, the following data are offered to the MONTHLY WEATHER REVIEW in advance of the publication of the regular monthly weather report for Jamaica:

Jamaica, W. I., climatological data, July, 1901.

	Negril Point Lighthouse.	Morant Point Lighthouse.
Latitude (north)	18° 15′	17° 55′
Longitude (west)	78° 23′	76° 10′
Elevation (feet)	33	8
Mean barometer, 7 a. m.	29.901	29.901
Mean barometer, 3 p. m.	29.878	29.870
Mean temperature, 7 a. m	79.2	.....
Mean temperature, 3 p. m	84.1	.....
Mean of maxima	87.6	.....
Mean of minima	74.2	.....
Highest maximum	92.0	.....
Lowest minimum	72.0	.....
Mean dew-point, 7 a. m	74.2	.....
Mean dew-point, 3 p. m	76.2	.....
Mean relative humidity, 7 a. m.	84.0	.....
Mean relative humidity, 3 p. m.	77.0	.....
Total rainfall (inches)	3.16	4.44
Average wind direction, 7 a. m	var.	var.
Average wind direction, 3 p. m	var.	var.
Average hourly velocity, miles, 7 a. m	7.5	8.2
Average hourly velocity, miles, 3 p. m	11.6	11.9
Average cloudiness (tenths):		
7 a. m. Lower clouds	0.1	2.2
7 a. m. Middle clouds	1.6	1.8
7 a. m. Upper clouds	4.4	1.0
3 p. m. Lower clouds	2.7	1.8
3 p. m. Middle clouds	5.3	2.0
3 p. m. Upper clouds	0.7	1.2

NOTE.—The pressures are reduced to standard temperature and gravity, to the Kew standard, and to mean sea level. The thermometers are exposed in Stevenson screens.

Comparative table of rainfall for each geographical division.

Divisions.	Relative area.	Number of available stations.	Rainfall. Average for May.	Rainfall. Current for May, 1901.
Northeastern division	25	21	6.20	7.70
Northern and subcentral division	22	54	3.19	7.23
Western-central division	26	26	8.25	10.19
Southern division	27	33	4.38	5.25
General means			5.51	7.59

In taking the average rainfall Mr. Hall uses only those stations for which he has several years of observation, so that the column of averages represents fairly well the normal rainfall for each division, while the column for the current month represents the average rainfall at those same stations. The relative areas of the divisions are very nearly the same and are given in the preceding table as expressed in percentages of the total area of Jamaica. The number of rainfall stations utilized in each area varies slightly from month to month, according as returns have come in promptly or not, but will not differ greatly from the numbers in the second column of the table.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during July*, 1901.

Hours.	Pressure. Observed, 1901.	Pressure. Normal, 1889-1900.	Temperature. Observed, 1901.	Temperature. Normal, 1889-1900.	Relative humidity. Observed, 1901.	Relative humidity. Normal, 1889-1900.	Rainfall. Observed, 1901.	Rainfall. Normal, 1889-1900.	Rainfall. Duration, 1901.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m.	3.46	3.70	17.08	17.65	95	91	1.0	1.1	1.49
2 a. m.	3.11	3.32	16.75	17.51	95	90	0.1	1.2	0.17
3 a. m.	2.95	3.08	16.50	17.11	94	91	0.0	2.5	0.00
4 a. m.	2.76	2.98	16.40	17.15	93	91	0.0	1.3	0.00
5 a. m.	2.83	3.10	16.25	17.04	93	91	0.0	0.4	0.00
6 a. m.	3.00	3.37	16.24	17.00	93	91	0.2	0.5	1.00
7 a. m.	3.37	3.76	17.79	18.23	89	87	0.0	0.6	0.00
8 a. m.	3.63	3.97	19.77	20.07	80	80	0.0	0.7	0.00
9 a. m.	3.86	4.15	21.84	21.64	72	75	0.0	1.2	0.00
10 a. m.	3.93	4.13	23.65	22.95	68	70	0.0	0.8	0.00
11 a. m.	3.76	4.04	24.08	23.71	69	69	0.0	1.4	0.00
12 m.	3.58	3.75	24.40	24.29	70	69	0.0	4.9	0.00
1 p. m.	3.14	3.35	23.36	24.11	74	69	8.4	14.8	1.00
2 p. m.	2.90	2.94	22.35	23.50	79	73	22.7	19.0	6.68
3 p. m.	2.58	2.68	21.45	22.50	83	76	19.3	23.7	7.91
4 p. m.	2.52	2.63	20.66	21.45	86	80	53.2	36.9	10.15
5 p. m.	2.72	2.83	19.75	20.53	90	83	68.7	34.9	10.88
6 p. m.	3.01	3.12	19.05	19.70	92	86	74.7	37.9	11.12
7 p. m.	3.37	3.55	18.64	19.04	94	89	48.5	20.7	11.83
8 p. m.	3.68	3.97	18.35	18.69	95	89	44.0	13.8	11.67
9 p. m.	3.93	4.20	18.09	18.44	95	90	17.3	7.8	7.92
10 p. m.	4.10	4.36	17.93	18.16	95	90	15.4	5.6	5.67
11 p. m.	4.08	4.35	17.66	17.96	95	90	4.0	2.9	3.08
Midnight	3.86	3.93	17.43	17.81	95	91	4.4	1.8	2.51
Mean	663.34	663.56	19.39	19.85	87	84	.....	.....	.....
Minimum	661.10	659.83	14.4	13.2	51	32	.....	.....	.....
Maximum	665.50	666.42	28.0	29.2	100	100	74.7	37.9	.....
Total	.....	.....	.....	.....	.....	.....	398.0	241.0	93.08

REMARKS.—The barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. The standard rain gage is 1.5 meters above ground. In the Costa Rican system the San Jose local time is used, which is $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time.

TABLE 2.

Time.	Sunshine. Observed, 1901.	Sunshine. Normal, 1889-1900.	Cloudiness observed, 1901.	Temperature of the soil at depth of— 0.15 *m.*	0.30 *m.*	0.60 *m.*	1.20 *m.*	3.00 *m.*
	Hours.	*Hours.*	%	° *C.*	° *C.*	° *C.*	° *C.*	° *C.*
7 a. m.	11.72	8.18	70	21.13	21.52	22.20	21.99	21.64
8 a. m.	18.89	15.97	.....	.....	.....	.....	.....	.....
9 a. m.	24.69	16.42	.....	.....	.....	.....	.....	.....
10 a. m.	22.16	15.42	70	21.45	21.58	22.23	23.01	.....
11 a. m.	16.97	14.94	.....	.....	.....	.....	.....	.....
12 m.	13.29	10.32	.....	.....	.....	.....	.....	.....
1 p. m.	5.30	9.65	89	21.91	21.70	22.24	22.00	.....
2 p. m.	4.83	8.84	.....	.....	.....	.....	.....	.....
3 p. m.	2.67	7.58	.....	.....	.....	.....	.....	.....
4 p. m.	3.42	5.17	96	21.92	21.77	22.19	21.97	.....
5 p. m.	0.48	3.19	.....	.....	.....	.....	.....	.....
6 p. m.	0.00	1.02	.....	.....	.....	.....	.....	.....
7 p. m.	.....	.....	97	21.81	21.71	22.18	21.96	.....
8 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m.	.....	.....	77	21.64	21.68	22.18	21.96	.....
11 p. m.	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	82	21.66	21.66	22.20	21.98	21.64
Total	124.42	118.52	.....	.....	.....	.....	.....	.....

Notes on the weather.—This month has been characterized on the Pacific slope by two periods of daily and generally heavy rainfall, separated by three days, 13th, 14th, 15th, of fair weather (veranillo); in San José the heaviest showers fell on the 2d and 29th, with 46 and 54 millimeters in 5 and 2 hours, respectively; the temperature was about normal for the season, the mornings being generally clear and bright (only two days without sun). On the Atlantic coast belt the drought continued, while heavy rainfall was reported from the interior.

Earthquakes.—July 11, $9^h\ 31^m$ p. m., slight shock, N–S, intensity II, duration 3 seconds; July 13, $8^h\ 28^m$ a. m., light shock, NNW–SSE, intensity II, duration 2 seconds; July 23, $9^h\ 43^m\ 30^s$ p. m., heavy shock, W–E, intensity III, duration 20 seconds; July 25, $2^h\ 40^m$ p. m., heavy shock, WNW–ESE, intensity III, duration 17 seconds; July 25, $7^h\ 1^m$ p. m., light tremors, N–S, intensity II, duration 5 seconds.

TABLE 3.—*Rainfall at stations in Costa Rica, July*, 1901.

Stations.	Amount.	No. rainy days.	Stations.	Amount.	No. rainy days.
	Mm.			*Mm.*	
1. Sipurio (Talamanca)	287	20	14. Juan Vinas	111	31
2. Boca Banano	141	14	15. Santiago	290	22
3. Limon	129	8	16 Paraiso	88	23
4. Swamp Mouth	128	6	17. Las Concavas	.....	.....
5. Zent	.....	.....	18. Cartago	.....	.....
6. Gute Hoffnung	275	14	19. Tres Rios	473	27
7. Siquirres	308	16	20. S. Francisco G	407	25
8. Guapiles	138	17	21. San Jose	398	24
9. Sarapiqui	.....	.....	22. La Verbena	415	27
10. San Carlos	332	26	23. Alajuela	466	25
11. Las Lomas	380	16	24. San Isidro Alajuela	549	27
12. Peralta	273	23	25. Nuestro Amo	369	29
13. Turrialba	291	22			

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means are now reduced to standard gravity.